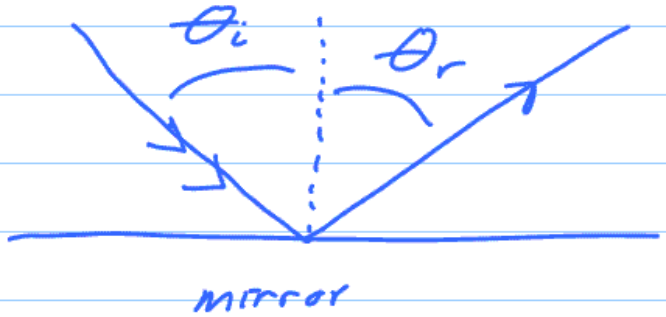
PHY132 - Class 7 - Monday January 26

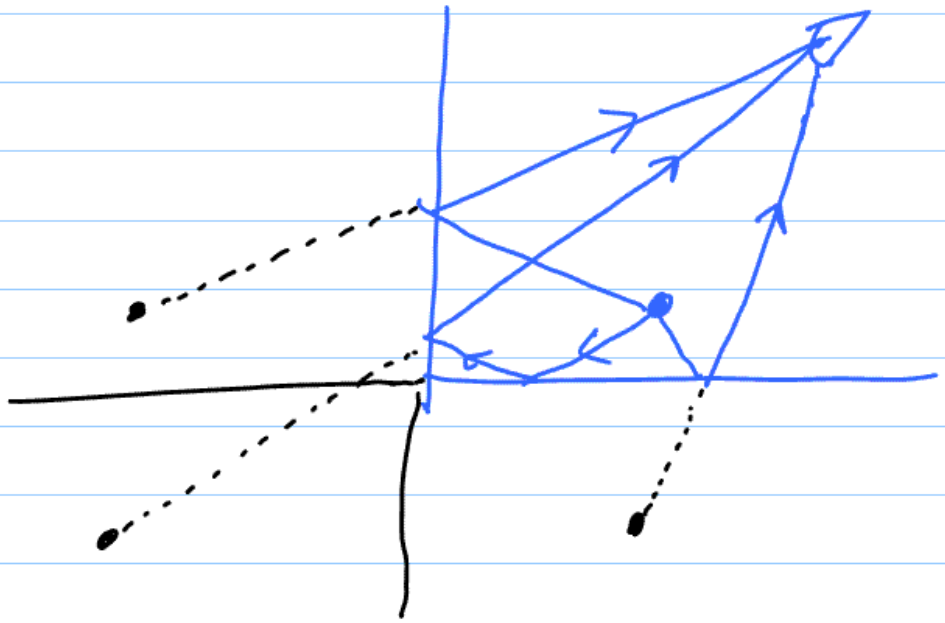
§23.2 - Reflection



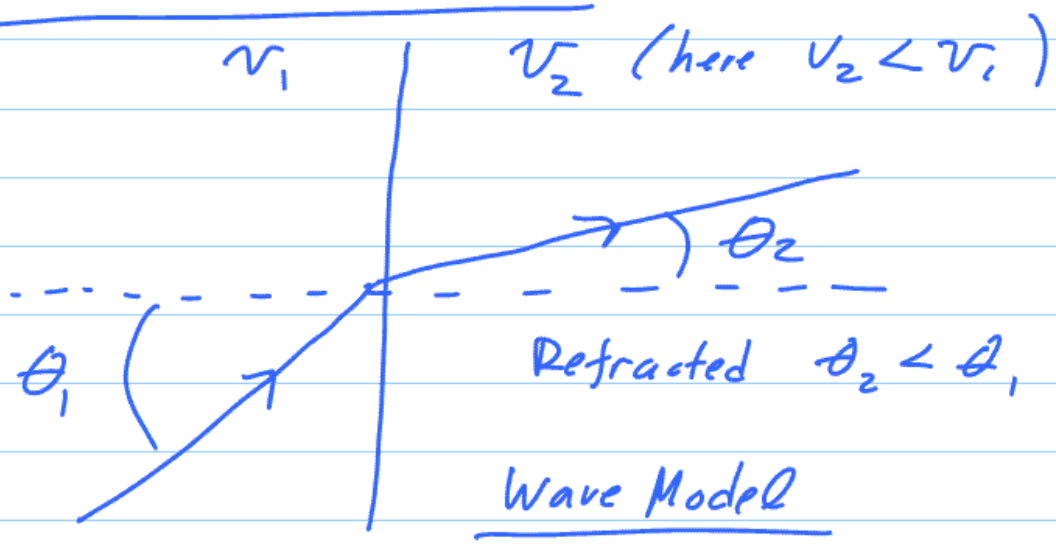
$\theta_i = \theta_r$

θ_i : angle of incidence

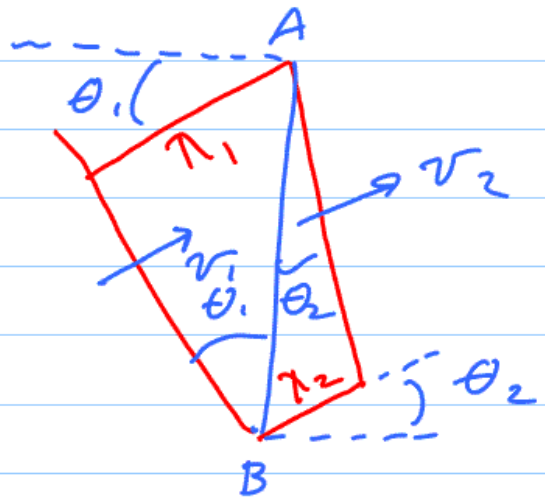
θ_r : angle of reflection



§ 23.3 - Refraction



Wave Model



$$\lambda_1 = \frac{v_1}{f} \qquad \sin\theta_1 = \frac{\lambda_1}{AB}$$

$$\lambda_2 = \frac{v_2}{f} \qquad \sin\theta_2 = \frac{\lambda_2}{AB}$$

$$\Rightarrow \boxed{\frac{\sin\theta_1}{v_1} = \frac{\sin\theta_2}{v_2}}$$

Recall $n \equiv \frac{c}{v}$

$$\boxed{n_1 \sin\theta_1 = n_2 \sin\theta_2}$$

Snell's Law Eqn 23.3

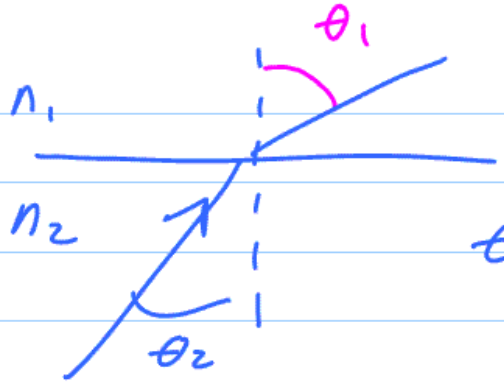
$n_{vacuum} = 1.00$ exactly

$n_{air} \cong 1.003$ (usually set to 1.00)

$n_{water} \cong 1.33$

$n_{glass} = 1.50$ (typical)

Corrected Jan 29



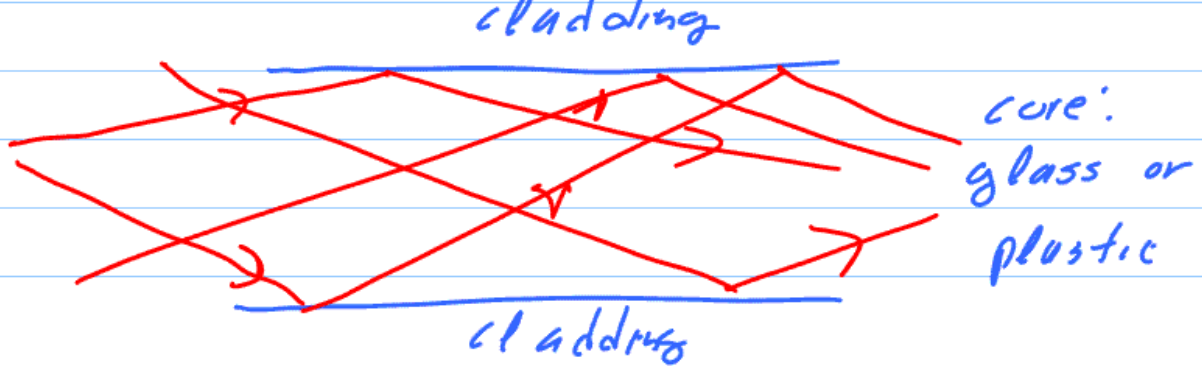
critical angle $\theta_c = \theta_2$ for which $\theta_1 = 90°$

$$n_2 \sin\theta_c = n_1 \sin 90° = n_1$$

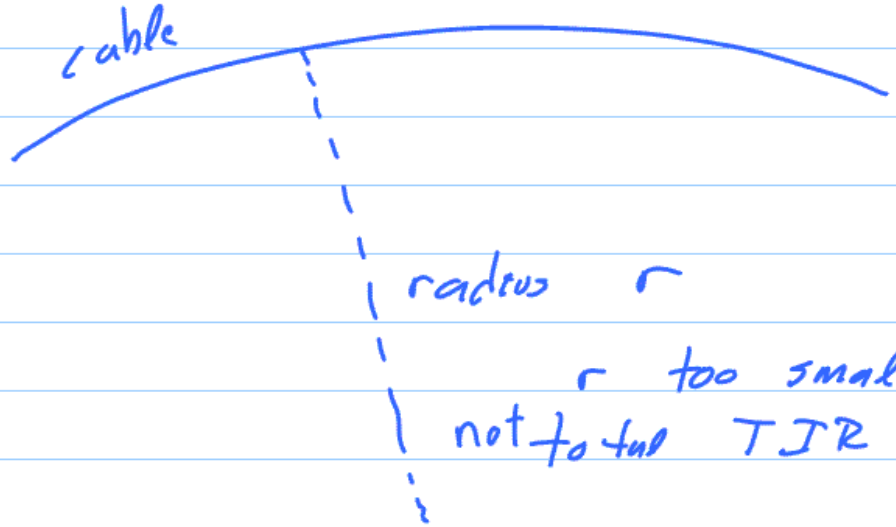
$$\boxed{\sin\theta_c = \frac{n_1}{n_2}}$$

$\theta_2 > \theta_c$: Total Internal Reflection (TIR)

Example: Optical Fibre



$n_{cladding} < n_{core}$



r: 2-3 cm

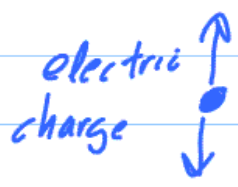
§23.4 - Images by Refraction

Lots more in §23.6 - Lenses.

§23.5 - Colour & Dispersion

You will learn!

SHM



wave of electric & magnetic fields

$f_{wave} = f_{source}$

transverse

$\lambda f = v$

$v_{vacuum} = c = 3 \times 10^8 \text{ m/s}$

$v_{air} \simeq c$

$v_{glass} = \frac{2}{3} c \qquad (n_{glass} = 1.5)$

$4.3 \times 10^{14} \text{ Hz} \leq f \leq 7.5 \times 10^{14} \text{ Hz}$

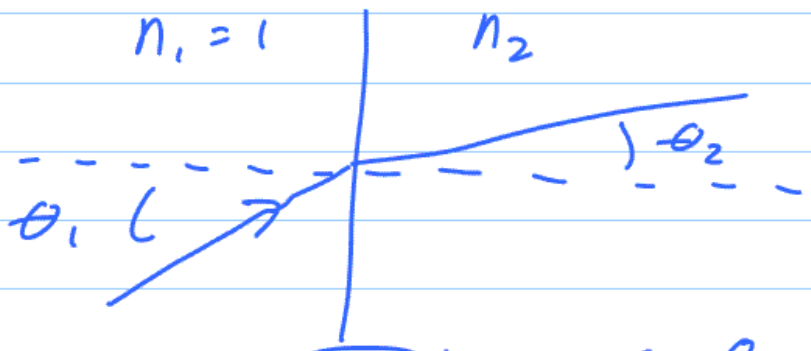
visible by eyes

Standard (poor) convention:

$400 \text{ nm} \lesssim \lambda \lesssim 700 \text{ nm}$

deepest violet — deepest red

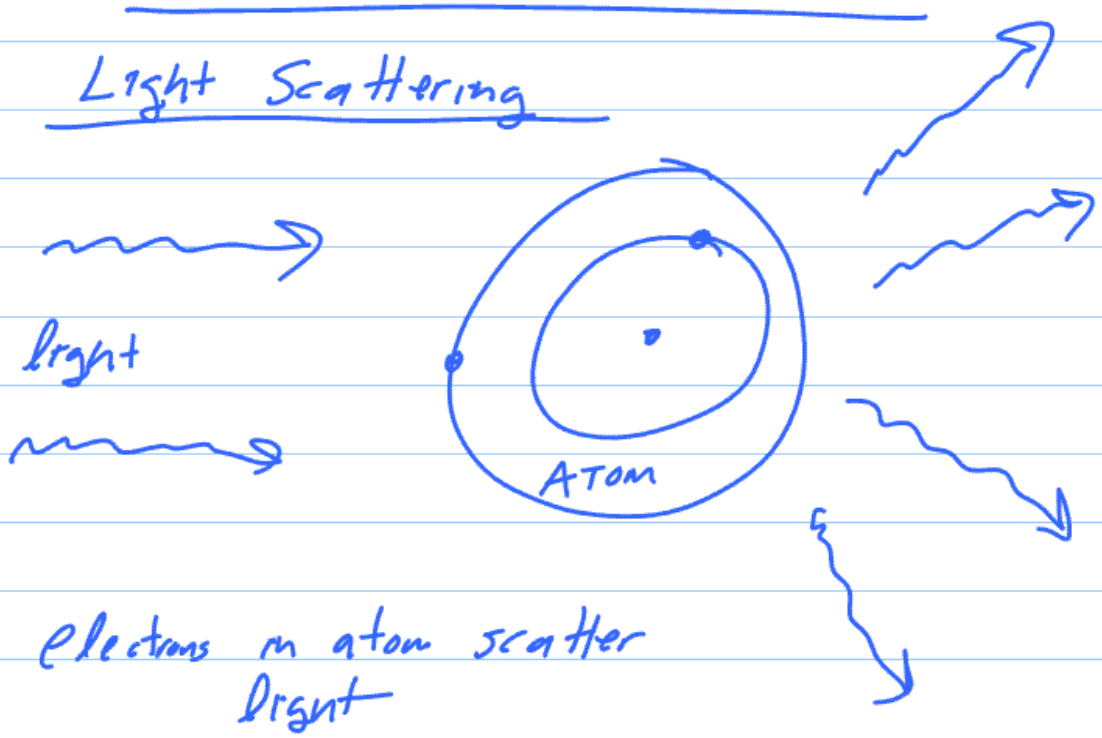
n_{glass} depends on λ



$$\sin\theta_2 = \frac{\sin\theta_1}{n_2}$$

depends on λ

Light Scattering



blue scattered 4 times more than red

"Rayleigh scattering"